

Runoff Reduction, Water Quality Benefits With Compost-Amended Soil

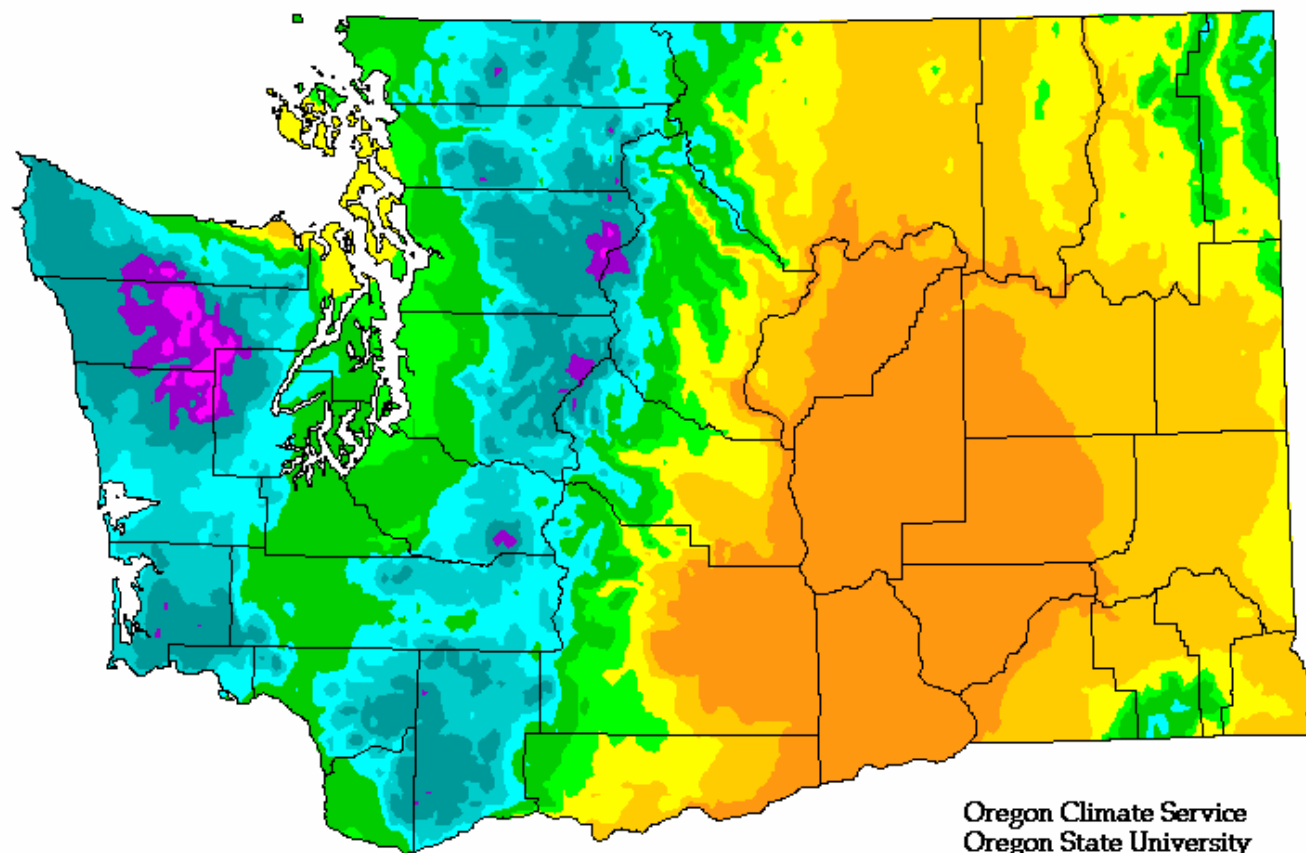
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Roadside and Site Development Manager

August 22 & 24, 2006



Average Annual Precipitation

Washington



Legend (in inches)

Under 10	60 to 80
10 to 20	80 to 100
20 to 30	100 to 140
30 to 40	140 to 180
40 to 60	Above 180

Period: 1961-1990

This map is a plot of 1961-1990 annual average precipitation contours from NOAA Cooperative stations and (where appropriate) USDA-NRCS SNOTEL stations. Christopher Daly used the PRISM model to generate the gridded estimates from which this map was derived; the modeled grid was approximately 4x4 km latitude/longitude, and was resampled to 2x2 km using a Gaussian filter. Mapping was performed by Jenny Weisberg and Nathaniel DeYoung. Funding was provided by USDA-NRCS National Water and Climate Center.

WSDOT Compost Specifications

- Stable, mature result of aerobic decomposition of organic matter.
- pH between 6.0 and 8.5
- Soluble Salt content below 4-6 mmhos/cm (1:5 Slurry Method, Mass Basis)
- Minimum organic matter of 40%
- We require STA Certification from US Composting Council of Lab and Producers



- WA State Dept of Ecology – initiative to reuse and reduce wastes. 3rd initiative is to increase recycling for organic materials.
- RCW 43.19A.050 Instructs WSDOT to increase purchases of recycled products. 80% of all soil amendments used on an annual basis must be compost. “Compost” must be derived from biological conversion of biosolids or cellulose-containing waste materials (RCW 43.19A.010)
- WAC 173-350 Sets Standards for Solid Waste Handling
- WSDOT partners with Ecology – share information & participate in compost operator training to get high quality compost

SR 8 Compost Amended Vegetated Filter Strip

- Two 12' lanes and an 8' shoulder drained onto the plots
- 3 plots approximately 20' long by 10' wide
- The plots were excavated to 18" deep
- One plot received standard roadway ex
- One plot received 12" roadway ex and 6" topsoil
- One plot received 12" roadway ex and 6" compost

SR 8 Compost Amended Vegetated Filter Strip

- The tests were to determine the level of contaminants in the runoff
- French drains were installed at the bottom of the plots
- We never got any runoff into the drain in the compost amended plot
- Therefore we couldn't prove it improved water quality (Conclusion - there must be something wrong with the test system)

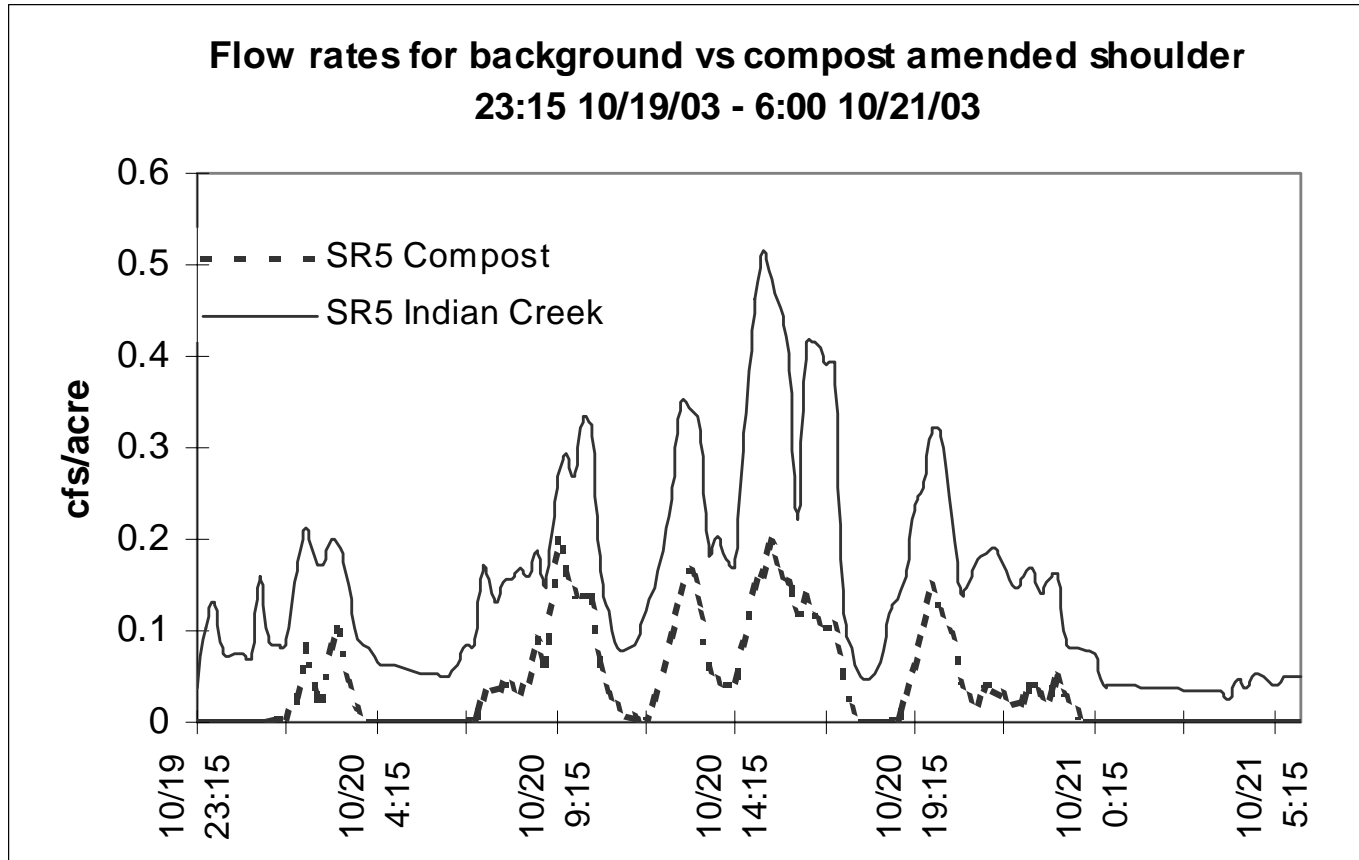
I-5 Martin Way Compost Amended Vegetated Filter Strip

- 4" compost blanket applied to a 10 wide strip
- 2 – 12' lanes and an 8' shoulder drain onto strip
- Water quantities were compared to flows into the Indian Creek stormwater facility
- October 16, 2003 – a 2.8 inch precipitation event produced no measurable runoff from the compost strip

I-5 Martin Way Compost Amended Vegetated Filter Strip

- October 20, 2003 produced over 4 inches of rain
- It infiltrated approximately 65% of the water coming off the highway
- This equates to more than 5 gallons of water for every square foot of the filter strip.
- Average pollutant loads were likely reduced by 75%

SR 5 ~ College Street Compost Blanket



Flow rates for CAVFS vs. Curb and Gutter

SR 5 ~ College Street Compost Blanket

Parameter	Untreated Runoff	Compost filter strip treated	% Concentration Reduction	% Load Reduction
	mg/l			
TDS	52.7	55.5	-5	63
T. Phosphorus	0.089	0.26	-192	-2
COD	73.5	49.6	33	76
TSS	81	23	72	90
	ug/l			
Total Copper	28.18	9.14	68	89
Dissolved Copper	7.85	5.77	26	74
Total Lead	12.62	3.54	72	90
Dissolved Lead	0.5	0.05	90	97
Total Zinc	129.70	31.57	76	91
Dissolved Zinc	64.22	20.71	68	89

- Overall reduction in pollutant levels except Total Dissolved Solids and Total Phosphorus
- When the flow reduction is factored in, there is an overall reduction of these two elements as well.

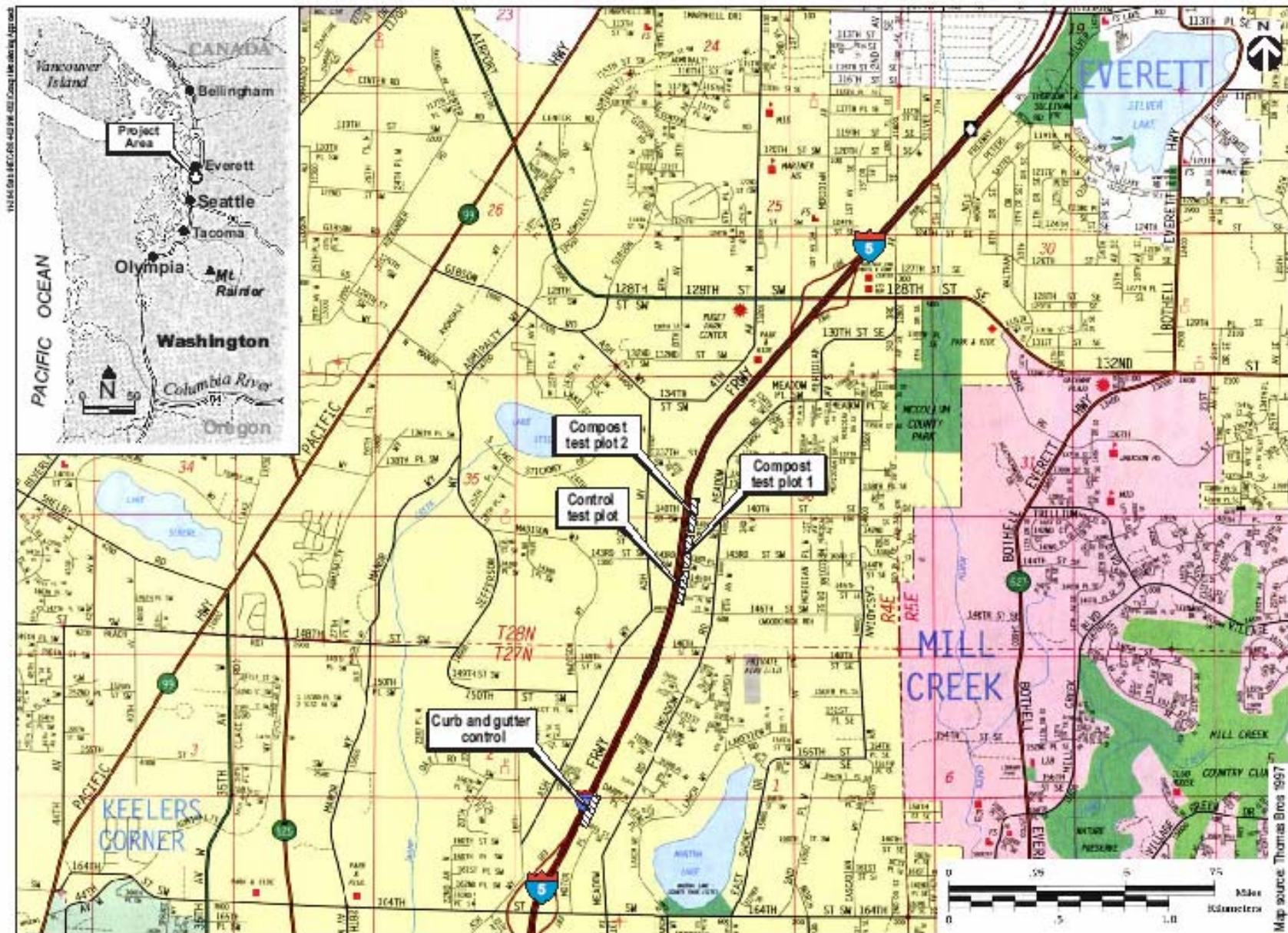


Figure 1. Vicinity map showing pilot filter strip locations along Interstate 5 in Snohomish County, Washington.

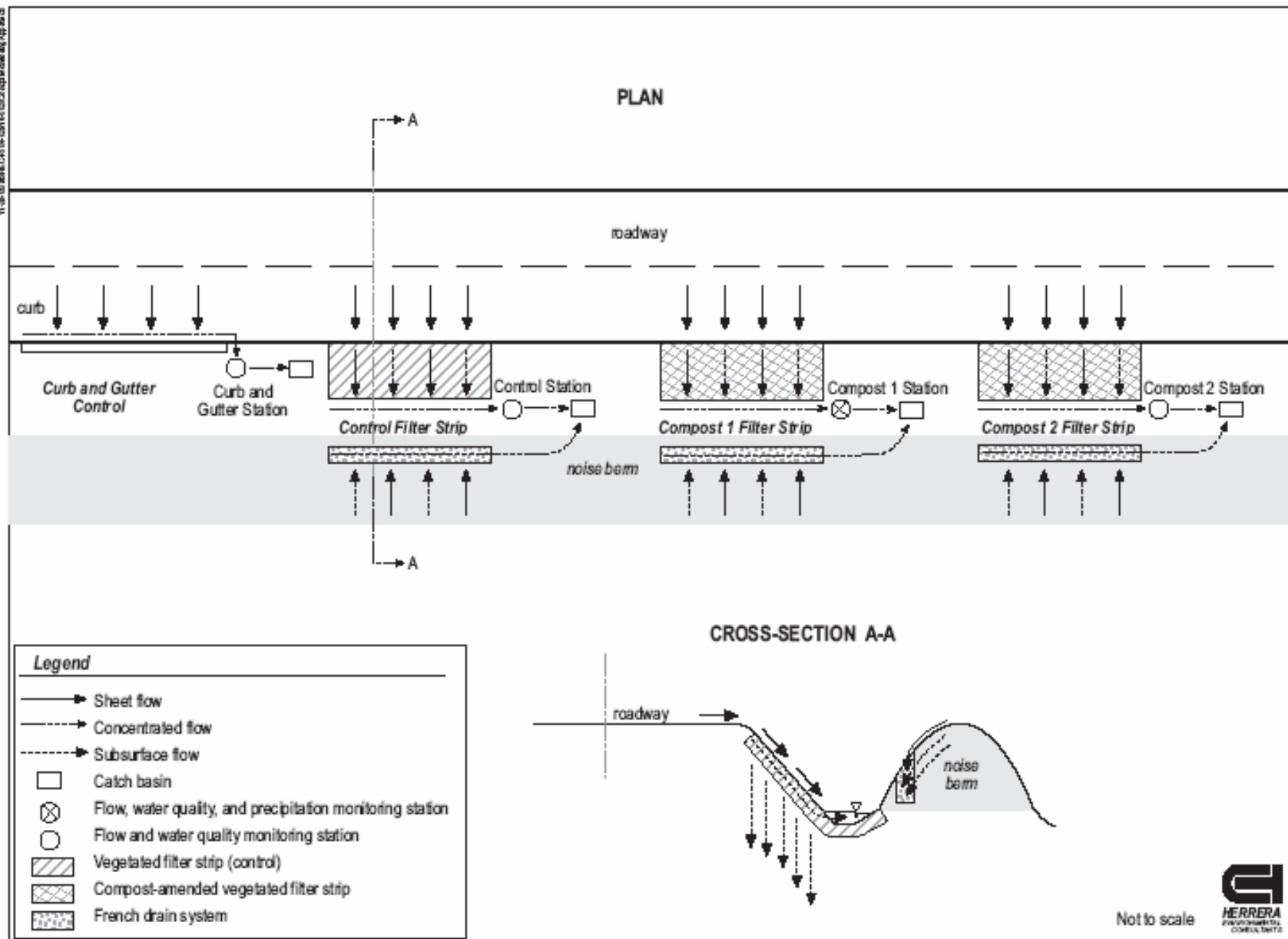
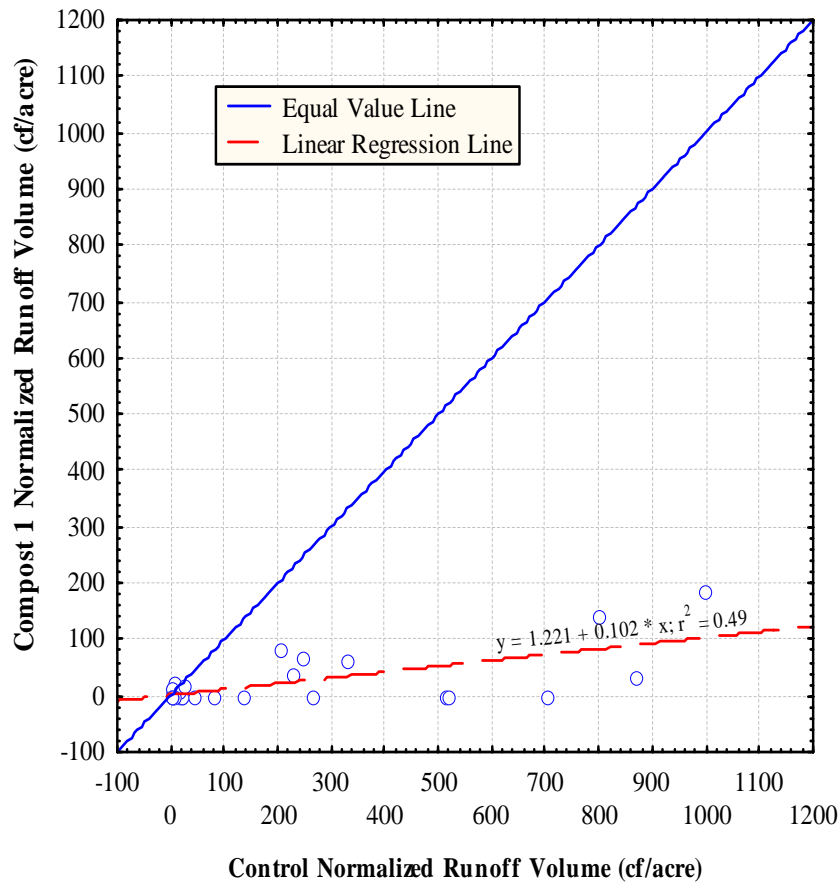
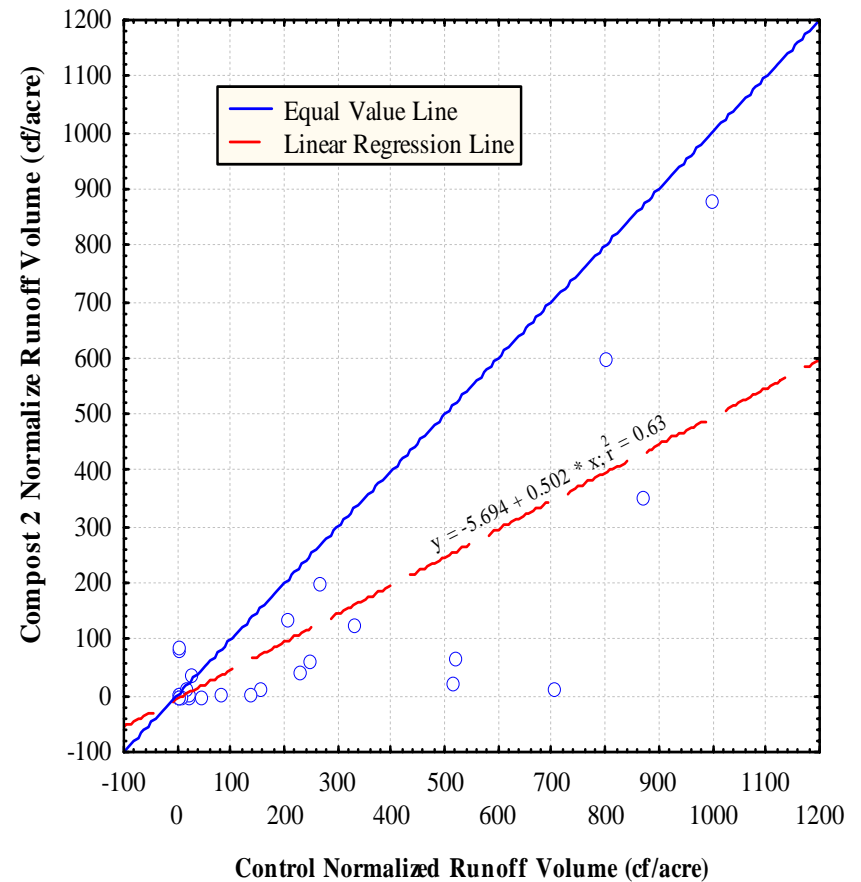


Figure 2. Schematic diagram of pilot filter strips and associated monitoring stations.

Comparison of Flow Volumes



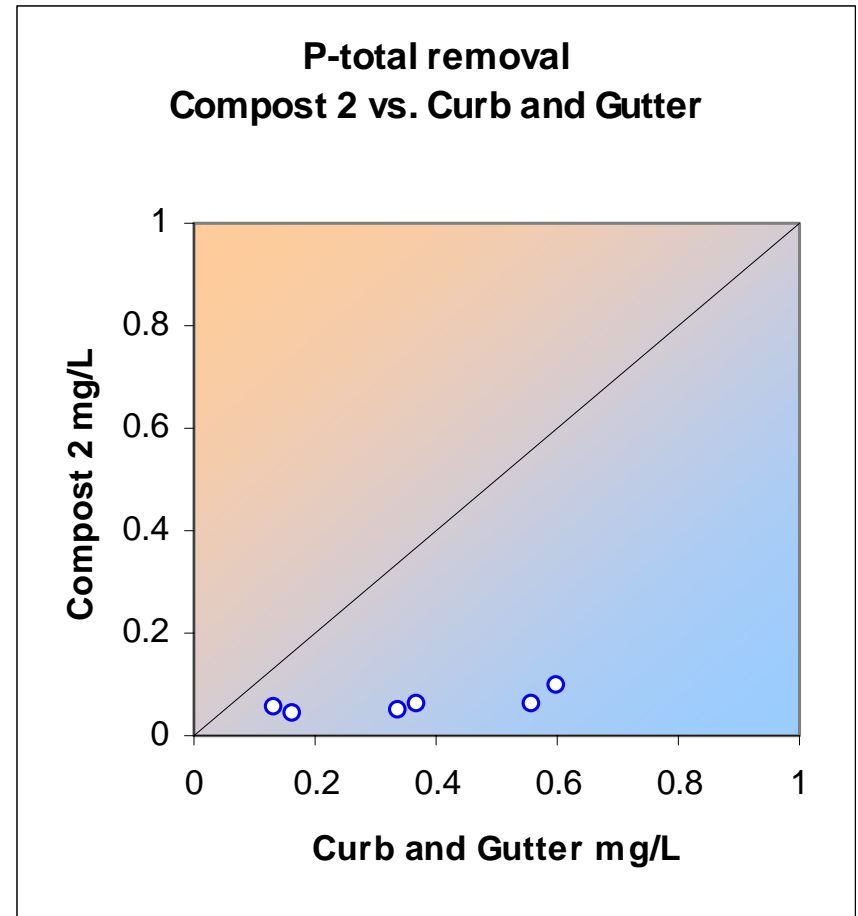
Sign Test p-value = 0.0015



Sign Test p-value = 0.0213

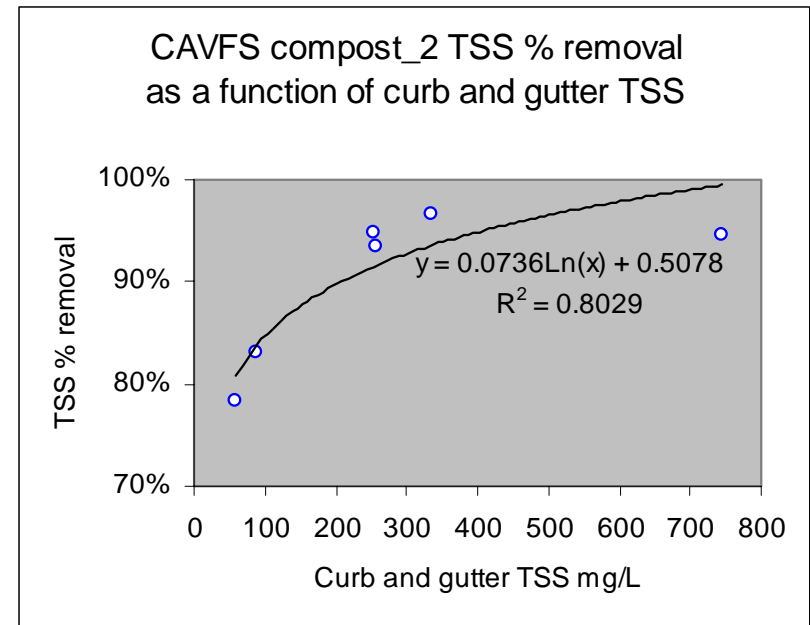
Total Phosphorus Removal Compost 2 vs. Curb and Gutter

- Total Phosphorus removal meets standards for enhanced treatment



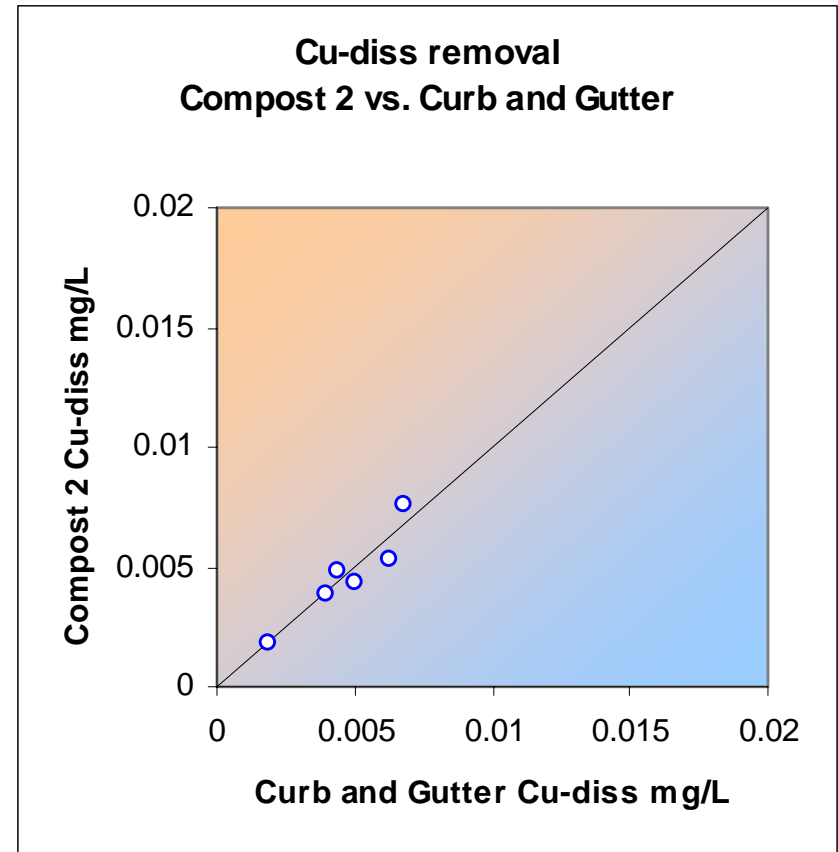
Total Suspended Solids % Removal by Compost 2 compared with Curb and Gutter

- Total Suspended Solids removal meets basic treatment requirement thresholds of 80%



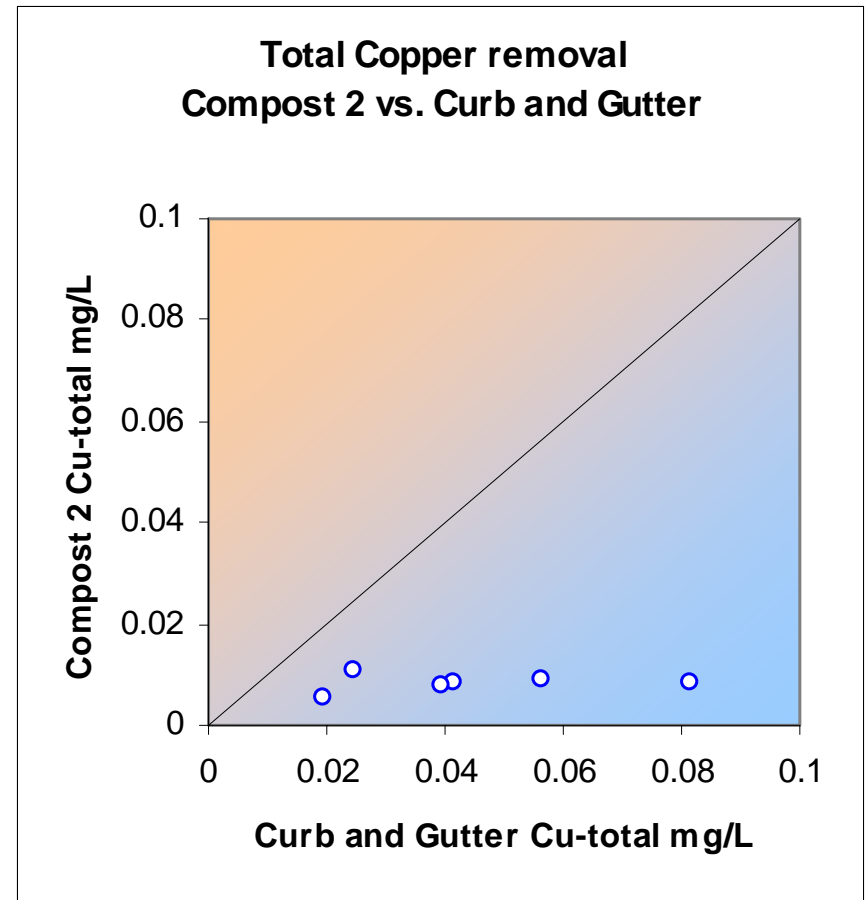
Dissolved Copper removal ~ Compost 2 vs. Curb and Gutter

- Dissolved Copper removal was inconsequential. Dissolved copper is very dependent on pH of soils.

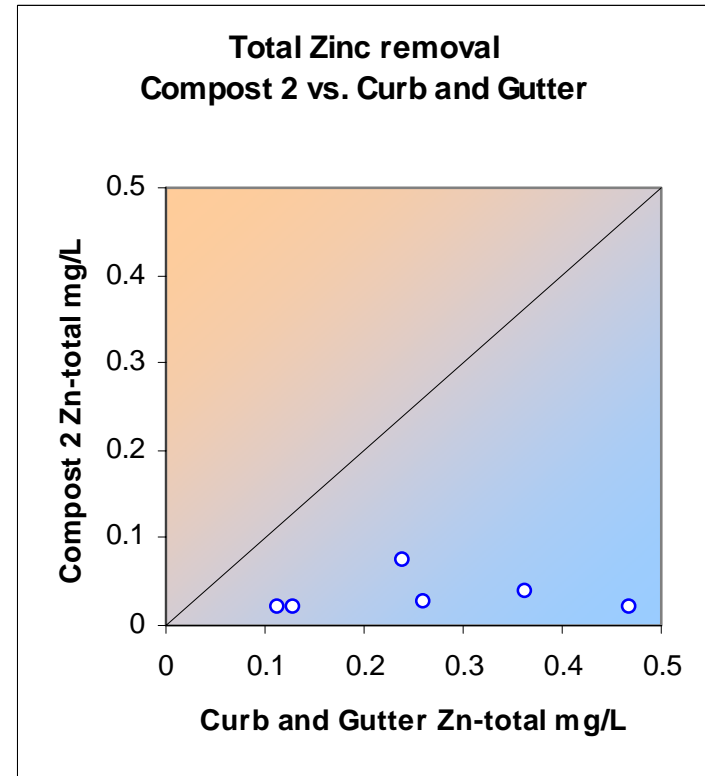
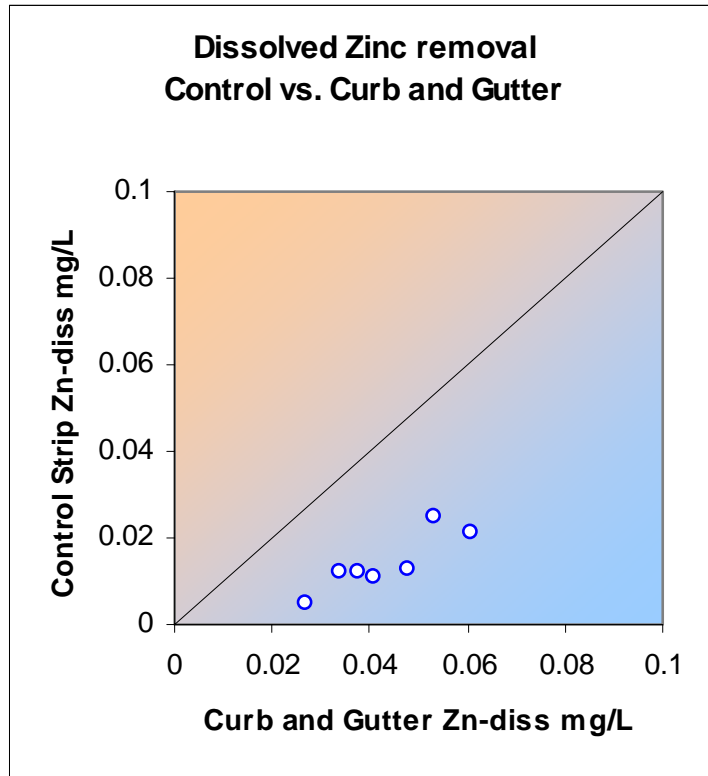


Total Copper Removal Compost 2 vs. Curb and Gutter

- Total Copper removal was excellent.



Dissolved and Total Zinc Removal ~ Compost 2 vs. Curb and Gutter



- Dissolved Zinc and Total Zinc removal exceeds enhanced treatment requirements of 50% removal.

SEA Streets Project

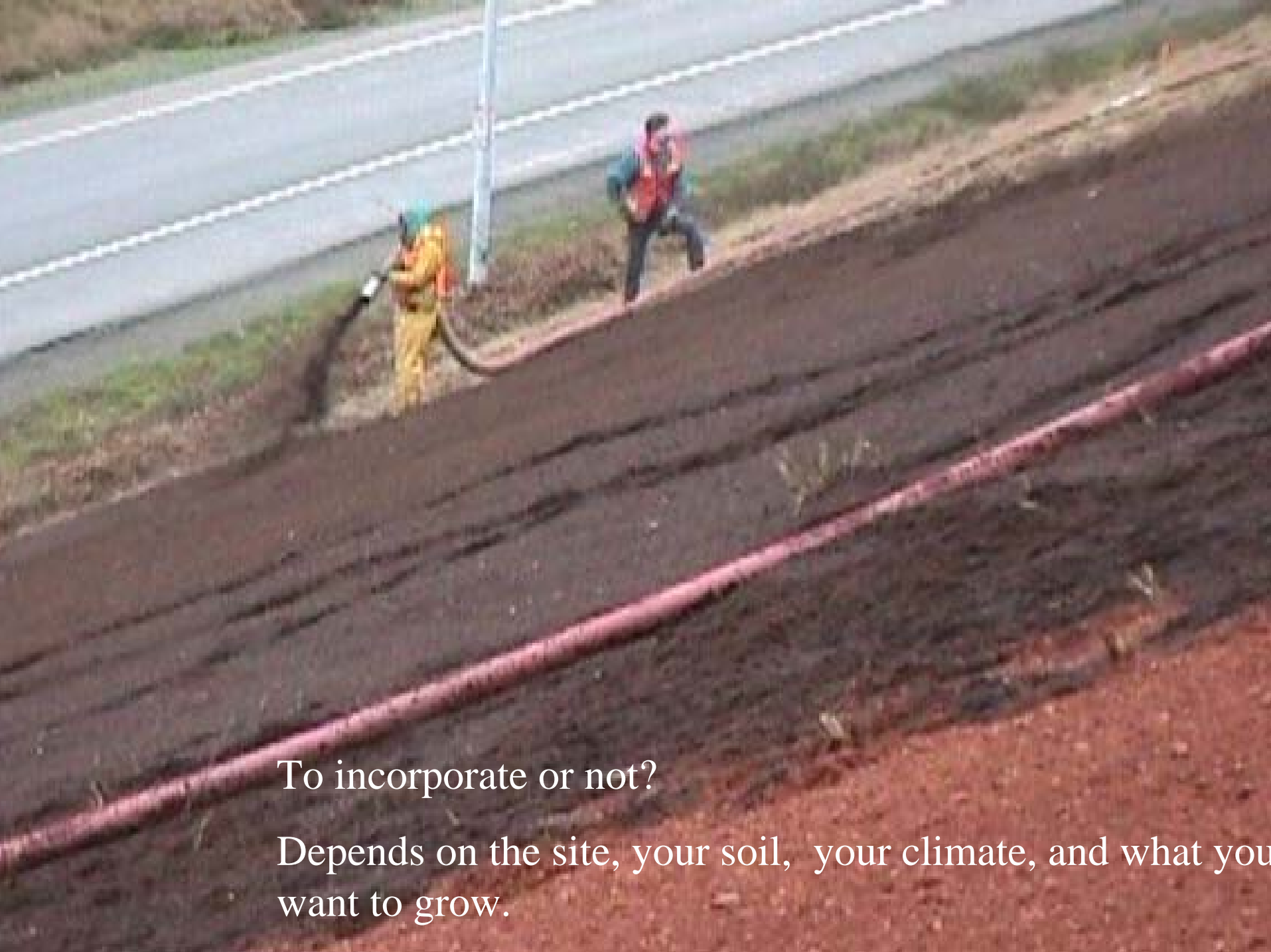


SEA Streets Project

- SEA ~ Street Edge Alternatives
- Two projects that drain 26 and 2.3 acres
- The 2nd Ave. project has prevented all dry season flow and 98% of the wet season runoff (Horner, et al)







To incorporate or not?

Depends on the site, your soil, your climate, and what you want to grow.





Applied at just over 1 inch depth – we ran out = Control Area



2000 7 20





SR 20, Methow River Bridge, Twisp



Compost – No Compost

Richland, May 2006

SR 12 Phase 2, with compost



SR 182 Queensgate, without compost



Compost – No Compost

Richland, May 2006



SR 182 Queensgate without compost



SR 12 Phase 2, with compost

SR 12 Phase 2, May 2006

Seeded Fall 2005



SR 182 Queensgate, May 2006

Seeded Fall 2005





Questions?

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Iowa State University Research

- Plots consisted of 3 types of compost blankets, 2 & 4 inches deep, 6" top soil, and bare soil
- 2 sets of 6 replicates of each plot, one set was bare and the other seeded per IDOT standard erosion control seed mix
- Plots were on a 3H:1V slopes
- Rainfall simulators applied 4 inches per hour

Iowa State University Research

- Runoff from compost-treated areas during a 30-minute high intensity rain storm was less than 0.8% of the runoff from areas treated with topsoil, and 0.5% or less of that from compacted subsoil.
- Compacted subsoil and topsoil typically began producing runoff within 5 to 8 minutes after rainfall began, areas treated with any of the three types of compost took, on average, 30 – 60 minutes to begin producing runoff

Iowa State University Research

- Nutrients & metals originally present in soils and compost
- Interrill runoff rates
- Interrill erosion rates
- Nutrients & metals in Interrill runoff
- Rill erosion rates
- Growth of planted erosion control vegetation
- Weed growth

Iowa State University Research

- There were no significant differences in interrill erosion between 2- and 4-inch compost treatments.
- With the exception of phosphorus in runoff from the biosolids compost, the total soluble mass of each of the three pollutants contained in runoff caused by a 30-minute storm was significantly lower in compost runoff than in runoff from conventionally-treated test plots. This is primarily the result of the significantly lower runoff produced by the compost blankets

Iowa State University Research

- Compost-treated areas produced as much planted cover-crop growth as conventionally-prepared roadside areas.
- Compost-treated plots produced significantly less weed growth than conventionally-prepared embankments.
- No significant difference between incorporation and blankets in most applications.